



TASER[®] SAFE, OR FLAMMABLE?

Using pepper sprays with electronic control devices

STORY & PHOTO BY CHRIS MYERS, RICK WYANT & TOM BURNS

In the early 1990s, portable less-lethal chemical agents became standard issue for patrol operations,¹ and these irritant sprays typically prove helpful when attempting to control resistive or violent subjects without serious injury or an escalation of force. However, with the reintroduction of electronic control devices (ECDs) such as the Taser in the late 1990s, there is a growing concern of flammability when these two less-lethal force options are used simultaneously or in close proximity.

In August 2005, for example, police officers in Kenosha, Wis., discovered their Tasers and pepper spray didn't mix when a suspect literally caught fire as they tried to subdue him. Kenosha Police Department Sergeant Ron Bartholemew told local television station WDJT, "When they deployed the Taser, it ignited the OC spray that was on him. It was like a quick flash fire." The suspect's face, head and the grass around him burst into flames.

In 2004 (and continuing through today), we began testing OC sprays used by local law enforcement. Our company, CRT Consulting, combines the practical knowledge of working police officers with the forensic expertise of a crime lab scientist. *Our goal:* to determine which brands of OC spray would ignite in combination with electronic control devices using a realistic test protocol. As word of this testing spread, more agencies contributed samples of OC for testing, and several manufacturers eventually contacted us as well and asked us to test their product lines so they would know how their products performed under our unique testing protocol.

Oleoresin Capsicum

The most common chemical agent used by law enforcement is oleoresin capsicum, otherwise known as OC or pepper spray. OC sprays contain several components, including a carrier, an emulsifier and propellant. They can be oil- or water-based,

and are available in different capsaicin concentrations. Every OC type does contain some quantity of flammable/volatile material, but the formulas generally remain unknown as manufacturers guard this proprietary information.

The U.S. Environmental Protection Agency has set standards for rating the flammability of liquids:²

- Flash point: the lowest temperature at which a liquid product containing a combustible ingredient that gives off a flammable vapor will ignite.²
- Note: Even though most of a liquid may be below its stated flash point, an ignition source (e.g., a Taser) can create a locally heated area sufficient to result in ignition.³
- Flame extension test: conducted by holding the aerosol can 6 inches from a flame and discharging the product across the flame. Flame extension of more than 18 inches or flashback of flame to the can would dictate the labeling of the

product as either flammable or extremely flammable.²

- Ignition of gases: Combustible substances in the gaseous state have extremely low mass and require the least amount of energy for ignition.³ Therefore, spray that becomes aerosolized when leaving the nozzle has the potential to be more flammable than its liquid form.

We believe the flash point and flame extension tests alone cannot accurately predict an ignition during a joint field application of OC spray and Taser or other electronic control devices. Law enforcement should not rely on these tests when selecting an OC projector in an environment that may contain an ignition source.

Our Testing Protocol

We created an experiment that would simulate a realistic, worst-case scenario. This scenario involves a clothing disconnect—i.e., a loose probe in the suspect's clothing with an exposed spark. An officer directly applies the spray to the spark, which is backed by the suspect's cotton t-shirt.

We used a Taser model M26 and nearly 50 formulations of OC spray. We chose the M26 over the X26 because of the greater output (1.76 peak joules for the M26 vs. 0.36 peak joules for the X26).⁴ We were attempting to create a realistic but worst-case, most-likely-to-ignite scenario. We worked under the theory that if the OC did not ignite under the worst-case situation, officers could comfortably carry the Taser and OC simultaneously in routine patrol operations.

We attached the probes from an XP Taser air cartridge to a forensic mannequin. We covered the mannequin with a conductive layer under an insulating layer to simulate the conductive and resistive characteristics of human skin. We placed typical cotton clothing over the insulating layer, and placed the probes 1 foot apart on the upper torso. We located the top probe in a fixture in the clothing a 1/2 inch from the conductive layer to simulate an arcing, clothing disconnect with exposed spark. The bottom probe penetrated the clothing and insulating layers, making direct

contact with the conductive layer.

We recorded the weather conditions because temperature and humidity affect the volatility of liquids, and we monitored the tests with digital still, video and thermal imaging. We changed the clothing after each test, and verified the circuit's conductivity. We applied the OC spray for 2–3 seconds from 3 feet away directly to the spark gap as the Taser cycled for 10 seconds. After a 20-second delay, we applied the Taser for a minimum of two cycles. The OC canister was not shaken prior to testing to maintain realistic field conditions.

The Results

Interestingly, the tests dispelled some common myths often heard in law enforcement circles, such as, "Water-based sprays are non-flammable" and "Cans marked 'non-flammable' are safe for use with Taser." We also noted that different models of the same brand did not always perform the same—fog, spray and foams bearing the same label may yield different results.

During our testing, several brands of OC ignited the cotton clothing on the mannequin during simultaneous application of Taser and OC. In some cases, a direct application of the OC product onto the Taser spark did not cause immediate ignition, but the reactivation of the Taser after a delay did cause flame. We think the flaming after a delay is due to a wicking effect in the cotton clothing used for testing.

(See pages 40–41 for the test results.)

Final Thoughts

This series of experiments was designed to create a practical, reality-based scenario similar to those faced by law enforcement officers in daily operations. It's foreseeable that officers will encounter situations in which electronic control devices and chemical agents are deployed simultaneously or in succession, whether by design or not.

We tried to obtain as many law enforcement-grade OC products as possible for testing, and one responsible manufacturer changed its formulas and resubmitted the new product for testing, which passed under our testing protocol. Some manufacturers chose not to partic-

ipate in this study, preferring to rely on flash-point and flame-extension standards to label their products. Some manufacturers have objected to this type of testing because it is not performed under controlled laboratory conditions. *The reality:* Cops don't work under laboratory conditions, so responsible testing must take place under realistic field conditions. Unfortunately, not all manufacturers want their products tested realistically.

We intentionally structured the testing scenario to be *worst case*, one most likely to produce ignition if the agent in question was combustible. These results are not and cannot be all inclusive and applicable to every situation. We recommend that agencies use these results only as a guideline for selecting chemical agents in an environment with potential for ECD deployment.

We will run another test this fall with cooperation from the NIJ and will post the results on our Web site. We recommend agencies test their own sprays using our testing protocol because the formulas in some brands change. **LOM**

References

1. Defense Technology/Federal Laboratories. *Armor Holdings Training Academy Manual*.
2. United States Environmental Protection Agency. *Label Review Manual, Chapter 9: Physical or Chemical Hazards*. 40 CFR 158.190.
3. National Fire Protection Association. *Guide for Fire and Explosion Investigations*. 1995.
4. Taser International. *Instructor Training Materials, Version 13*.

CHRIS MYERS is a police officer and instructor on less-lethal options including the Taser, specialty impact munitions and chemical agents and tactics.

RICK WYANT is a forensic scientist with the Washington State Patrol in Seattle. He is a nationally recognized expert in forensic reconstruction of electronic control device incidents and analysis of Taser evidence. He is a distinguished member of the Association of Firearm and Toolmark Examiners, a SWGGUN board member and a reserve deputy.

TOM BURNS is a police officer and instructor on less-lethal options, including specialty impact munitions, chemical agents, crowd-control tactics, and Tasers.

CRT CONSULTING has presented on a variety of law enforcement topics in Europe, Canada and throughout the United States. All three authors have contributed to the NIJ Less-Lethal Technical Working Group. They work together to test various less-lethal options under realistic conditions and instruct officers how to effectively apply this technology within its limitations. For more information, visit www.crtlesslethal.com.

TASER-OC FLAME TEST RESULTS >>

TASER-OC FLAME TEST RESULTS

BRAND	TYPE	LOT #
AERKO Punch II	stream	not listed
AERKO Punch II	stream	not listed
AERKO FREEZE +P, OC-CS	stream	not listed
AERKO Punch III	stream	PIIIF-180; Exp 07/06
AERKO Punch III	stream	PIIIF-11/07
Body Guard LE10 (Def Tech) *	stream	0279649
Body Guard LE10 (Def Tech) *	fog	243057C
Body Guard LE10 (Def Tech) * **	foam	061193
Clear Out	fog grenade	not listed
Counter Assault OC-10**	stream	OC10-2S
Counter Assault OC-10	stream	OC10-4S
Counter Assault OC-10*	fog	OC10-4M
CTS Mk 4 **	fog	not listed
CTS Mk9	fog	not listed
Curds	stream	B50I3001
Def Tech Pepper Foam 10% *	foam	067562
Def Tech First Defense MK-IV*	stream	OC78303035465
Def Tech First Defense X2	stream	not listed
Def Tech 5.5 Pepper mace*	stream	PMS063
Def Tech Pepper 10*	stream	OC780 54135P104b
Def Tech First Defense MK-9*	fog	not listed
FOX spray*	stream	not listed
FOX spray	fog	not listed
FOX Mark 9 size	fog	not listed
Guardian	fog	I-2804-B
Guardian	stream	not listed
Mace Sec. Int'l TAKEDOWN	gel	L732481
TAKEDOWN OC/CS blend	stream	2003L703150
TAKEDOWN OC/CS blend	stream	2006L780984
TAKEDOWN OC 5.5	fog	L729203 Manu 2004
TAKEDOWN OC 5.5	fog	L729164
TAKEDOWN OC 5.5	stream	L763488 Manu 2006
TAKEDOWN OC 5.5	stream	L763508 Manu 2006
TAKEDOWN 10%	stream	L781047 Manu 2006
TAKEDOWN Inert	stream	L778864
Pepperball	cone	not listed
Pepperball	stream	not listed
SABRE CS/Red pepper	stream	not listed
SABRE RED	foam	not listed
SABRE Red- H2O	stream	100303a-00481085
SABRE Red- H2O	foam	092104-2 00583600
SABRE Red- H2O	fog	521010
TDS Tactical Defense Spray	fog	not listed
TDS Tactical Defense Spray	stream	not listed
Zarc International Cap-Stun	fog	9250A
Zarc Vexor V7	foam	2004A001663
Zarc Vexor V7	stream	1006A000127
Zarc Vexor V7	stream	0606A002089

RESULTS	COMMENTS
Flame with ignition	Marked "flammable"
Flame with ignition	Marked "non flammable"
No ignition	
Flame and ignition	Marked "non flammable"
No ignition	Marked "non flammable"
Flame with ignition after delay	Ignited after delay
No ignition	
No ignition, but generated heat	Generated heat/steam
Instant, large flame /ignition	Marked "non flammable"
Smoke only	
Flame , no ignition	
No ignition	
No ignition, but generated heat	
No ignition	
Flame , no ignition	German; generated heat
No ignition	
No ignition	
No ignition	
Flame with ignition	Marked "EDW Tested and Safe"
No ignition	
No ignition	
No ignition	
Flame /ignition after small delay	Marked "non flammable"
Flame and ignition	
No ignition	
No ignition	Product demonstrated a cooling effect measured by thermal imaging on the Taser Arc
Flame , no ignition	
No ignition	
Flame with ignition	
Flame with ignition	Marked flammable
No ignition	Marked "non flammable"
Flame /ignition after delay	Marked "non flammable"
No ignition	Marked "non flammable"
No ignition	Marked "non flammable"
No ignition	
Flame and ignition	Can with black label
No ignition	
No ignition	Can with blue label
No ignition	Can with blue label
No ignition	Can with blue label
Flame and ignition	Marked "non flammable"
Flame and ignition	Marked "non flammable"
Flame and ignition	
No ignition	* Tested twice with different lot numbers with the same results. Some have more than one lot number tested with the same results.
No ignition	** Did not ignite, but raised concerns with high heat generation or hot vapor production.
No ignition	